STEREO PROCESSING OF MAGELLAN SAR IMAGERY PERFORMED ON A TRANSPUTER ARCHITECTURE

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ABSTRACT

A stereo processing system has been implemented at the Jet Propulsion Laboratory using a Pacific Parallel Research 16-node transputer architecture, The stereo software developed by Dr. Meemong Lee involves using an area matching method based on a type of image representation called "Multi-resolution pyramid" and consists of performing matching of large features first before matching detailed terrain, in a way similar to how human vision works, The result is a high resolution digital elevation map (DEM) created from a pair of images. All aspects of the stereo processing system utilize the transputer, including image reduction and expansion, bandpass filtering, and correlation. The software is written in C++ with imbedded commands for using the transputer.

The software was originally intended for use with optical images. Recently, radar images appropriate for stereo processing were acquired by the Magellan spacecraft, With few modifications, the software has been successfully run on pairs of standard Magellan mosaic image data records (MIDRs) and has produced DEMs of the surface of Venus with a maximum spatial resolution of 300 meters which is approaching the 75 meter image pixels of the data itself, **The details of the algorithm used and its performance are presented. The benefits of using an area matching scheme on radar images are explained.**

in order to determine the accuracy of these results for Magellan data, the effects of using mosaicked imagery, of the radar geometry, and of the spacecraft ephemeris were also examined. At the Multi-mission Image Processing Laboratory (M IPL), the MIDRs are built up by mosaicking overlapping orbits of Full-resolution Basic Image Data Records (F-BIDRs). A system was developed for saving from the F-BIDRs the incidence angle profile along the ground track of the orbit and varying the incidence angle across the width of the orbit, The **F-BIDRs have also been rectified to a coarse topo model.** A **method for removing this rectification to derive a DEM relative to the center of the planet is explained.**

The spacecraft ephemeris was derived from ground-based Doppler tracking with each navigation solution covering a block of 7 or 8 orbits, At the boundaries of the navigation solutions the relative orbit-to-orbit ephemeris errors are large as 700m because the ephemerides are computed from independent numerical integrations and based on different sets of tracking observations. **These errors show up in the resultant MIDRs** as mis-registrations between adjacent orbits over those boundaries in the along-track and cross-track directions. **The cross-track errors create artificial "cliffs" in the digital elevation maps which are based upon the measuring the parallax between pairs of MIDRs.** These "cliffs" can be as great as 1000 meters in height.

(This work is being performed at the Jet Propulsion Laboratory, California Institute of Technology, under contract with NASA.)